CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
J0808

Project Title
Is Seawater an Efficient Medium for Electrolysis? A Model for Solar Powered Hydrogen Production

Abstract

Objectives/Goals
The basis of my project was to investigate if natural seawater was comparable to artificially prepared solutions in providing an efficient means of hydrogen production through solar-powered electrolysis. This was an attempt to provide a model for a completely natural means for the production of hydrogen as a substitute for petroleum fuels.

Methods/Materials
Seawater and 1.0 M solutions of sulfuric acid and sodium hydroxide were electrolyzed in a self-constructed, solar-powered electrolysis apparatus capable of measuring the temperature, pressure, and volume of the hydrogen gas produced. The experiment was repeated in identical controlled conditions seven times for each of the three solutions that were tested. Due to the fact that equal volumes of gas were not being collected in each of the trials, millimoles of hydrogen produced were divided by time elapsed to produce consistent data. Millimoles of hydrogen produced were calculated by manipulating The Ideal Gas Law, Daltons Law of partial pressures, and Guy-Lussacs Law.

Results
From the accumulated data, the 1.0 M Sodium Hydroxide solution proved itself to be slightly more efficient in hydrogen production. It generated an average of .66661 millimoles of hydrogen (H2) produced per hour. The 1.0 M sulfuric acid produced an appreciable .65790 millimoles of hydrogen per hour. The seawater solution produced a comparable .65714 millimoles of hydrogen per hour. From the data acquired in the seven trials for each of the solutions I calculated the standard deviations to emphasize and ensure the consistency of the data. The standard deviations for the three solutions are 0.02732, 0.03706, and 0.05299 respectively.

Conclusions/Discussion
My data suggested that seawater was comparable to 1.0 M sodium hydroxide and 1.0 M sulfuric acid solutions in the efficiency of solar- powered hydrogen production. There was only a 1.4% difference in hydrogen production per hour than the most efficient solution, sodium hydroxide, and a mere 0.1% less than the sulfuric acid.

Summary Statement
My study focused on determining if seawater was comparable to artificial solutions in the efficiency of solar-powered hydrogen production.

Help Received
Mr. Garabedian provided supplies necessary for my project. Mr. and Mrs. Hoffmann also provided supplies and advice. Parents helped assemble board.